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ABSTRACT

This panel's goal was to develop an understanding of the mental life of teachers, a research-based conception of the cognitive processes that characterize that mental life, their antecedents, and their consequences for teaching and student performance. Such cognitive processes include perception, expectancies, diagnostic judgment, prescription, and decision-making. Such an understanding can be applied in further research on teacher selection, teacher education, and the development of technological or staffing innovations congruent with ways teachers think and feel. The panel was most concerned with improving understanding of ways in which teachers cope with the demands of classroom life as a basis for the improvement of teaching. The discussion included a conceptual model for clinical information processing in teaching, an examination of the problems of teaching, and an explanation of the rationale for the seven approaches which the panel selected in order to achieve their goal. These seven approaches dealt with (1) the clinical act of teaching; (2) perceptions, attributions, and expectations; (3) cognitive processes in selecting among instructional and organizational alternatives; (4) teacher perceptions of self, role, and teaching; (5) organizational and structural determinants of cognitive functioning in teachers; (6) development of research models; and (7) theory development. (BD)

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NIE CONFERENCE ON STUDIES IN TEACHING

PANEL 6

TEACHING AS CLINICAL INFORMATION PROCESSING

GOAL STATEMENT

To develop an understanding of the mental life of teachers, a research-based conception of the cognitive processes that characterize that mental life, their antecedents, and their consequences for teaching and student performance. Such cognitive processes include perception, expectancies, diagnostic judgment, prescription and decision-making. Such an understanding can be applied in further research on teacher selection, teacher education, and the development of technological or staffing innovations congruent with ways teachers think and feel.

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February, 1975

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PREFACE

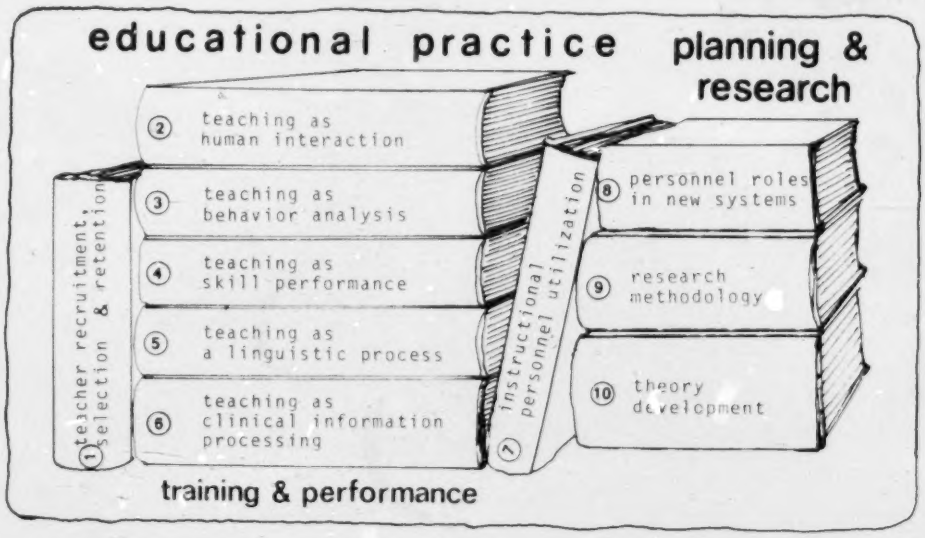
The volume before you is the report of one of ten parels that participated in a five-day conference in Washington during the summer of 1974. The primary objective of this Conference was to provide an agenda for further research and development to guide the Institute in its planning and funding over the next several years. Both by the involvement of some 100 respected practitioners, administrators, and researchers as panelists, and by the public debate and criticism of the panel reports, the Institute aims to create a major role for the practitioner and research communities in determining the direction of government funding.

The Conference itself is seen as only an event in the middle of the process. In many months of preparation for the Conference, the staff met with a number of groups--students, teachers, administrators, etc.--to develop coherent problem statements which served as a charge to the panelists. Panel chairmen and others met both before and after the Conference. Several other panelists were commissioned to pull together the major themes and recommendations that kept recurring in different panels (being reported in a separate Conference Summary Report). Reports are being distributed to practitioner and research communities. The Institute encourages other interest groups to debate and critique relevant panel reports from their own perspectives.

The Conference rationale stems from the frank acknowledgment that much of the funding for educational research and development projects has not been coordinated and sequenced in such a way as to avoid undue duplication yet fill significant gaps, or in such a way as to build a cumulative impact relevant to educational practice. Nor have an agency's affected constituencies ordinarily had the opportunity for public discussion of funding alternatives and proposed directions prior to the actual allocation of funds. The Conference is thus seen as the first major Federal effort to develop a coordinated research effort in the social sciences, the only comparable efforts being the National Cancer Plan and the National Heart and Lung Institute Plan, which served as models for the present Conference.

As one of the Conference panels points out, education in the United States is moving toward change, whether we do anything about it or not. The outcomes of sound research and development--though enlisting only a minute protion of the education dollar--provide the leverage by which such change can be afforded coherent direction.

In implementing these notions for the area of teaching, the Conference panels were organized around the major points in the career of a teacher: the teacher's recruitment and selection (one panel), training (five panels), and utilization (one panel). In addition, a panel was formed to examine the role of the teacher in new instructional systems. Finally, there were two panels dealing with research methodology and theory development.


educational practice
planning & research
② teaching as human interaction
③ teaching as behavior analysis
④ teaching as skill performance
⑤ teaching as a linguistic process
⑥ teaching as clinical information processing
① teacher recruitment, selection & retention
⑦ instructional personnel utilization
⑧ personnel roles in new systems
⑨ research methodology
⑩ theory development
training & performance

Within its specific problem area, each panel refined its goal statement, outlined several "approaches" or overall strategies, identified potential "programs" within each approach, and sketched out illustrative projects so far as this was appropriate and feasible.

Since the brunt of this work was done in concentrated sessions in the space of a few days, the resulting documents are not polished, internally consistent, or exhaustive. They are working papers, and their publication is intended to stimulate debate and refinement. The full list of panel reports is given on the following page. We expect serious and concerned readers of the reports to have suggestions and comments. Such comments, or requests for other panel reports, should be directed to:

Assistant Director
Program on Teaching and Curriculum
National Institute of Education
1900 M Street, N.W.
Washington, D. C. 20208

As the organizer and overall chairman for the Conference and editor for this series of reports, Professor N. L. Gage of Stanford University richly deserves the appreciation of those in the field of teaching research and development. The panel chairpersons, singly and together, did remarkable jobs with the ambitious charge placed before them. Special acknowledgments are due to Philip Winne of Stanford University and to Arthur Young & Company for coordination and arrangements before, during, and after the Conference. But in sum toto, it is the expert panelists--each of whom made unique contributions in his respective area--who must be given credit for making the Conference productive up to the present stage. It is now up to the reader to carry through the refinement that the panelists have placed in your hands.

Garry L. McDaniels
Program on Teaching and Curriculum

LIST OF PANEL REPORTS AND CHAIRPERSONS

1. Teacher Recruitment, Selection, and Retention, Dr. James Deneen, Educational Testing Service
2. Teaching as Human Interaction, Dr. Ned A. Flanders, Far West Laboratory for Educational Research and Development
3. Teaching as Behavior Analysis, Dr. Don Bushell, Jr., University of Kansas
4. Teaching as Skill Performance, Dr. Richard Turner, Indiana University.
5. Teaching as a Linguistic Process in a Cultural Setting, Dr. Courtney Cazden, Harvard University
6. Teaching as Clinical Information Processing, Dr. Lee S. Shulman, Michigan State University
7. Instructional Personnel Utilization, Dean Robert Egbert, University of Nebraska
8. Personnel Roles in New Instructional Systems, Dr. Susan Meyer Markle, University of Illinois
9. Research Methodology, Dr. Andrew Porter, Michigan State University
10. Theory Development, Dr. Richard Snow, Stanford University

- Conference on Studies in Teaching: Summary Report, Dr. N. L. Gage, Stanford University

INTRODUCTION

Discussion of Panel Goals

Statement of Goal: To develop an understanding of the mental life of teachers, a research-based conception of the cognitive processes that characterize that mental life, their antecedents, and their consequences for teaching and student performance.

The cognitive processes with which Panel 6 was concerned include perception, expectancies, diagnostic judgment, prescription, and decision making. An understanding of these processes can be applied in further research on teacher selection, teacher education, and the development of technological or staffing innovations congruent with ways teachers think and feel.

The approaches and programs of research to be described rest on the assumption that we need to know much more about the mental life of teachers. Though it is possible, and even popular, to talk about teacher behavior, it is obvious that what teachers do is directed in no small measure by what they think. Moreover, it will be necessary for any innovations in the context, practices, and technology of teaching to be mediated through the minds and motives of teachers. To the extent that observed or intended teacher behavior is "thoughtless," it makes no use of the human teacher's most unique attributes. In so doing, it becomes mechanical and might well be done by a machine. If, however, teaching is done and, in all likelihood, will continue to be done by human teachers, the question of the relationships between thought and action becomes crucial.

This emphasis on the cognitive functioning of teachers is consistent not only with the realities of classroom life but with important developments in contemporary behavioral and social science. One behavioral scientist, Herbert Simon, has observed that

> . . . The capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problems whose solution is required for objectively rational behavior in the real world--or even

> for a reasonable approximation to such objective rationality. [After proposing the principle of 'bounded rationality' to describe man's limited capacity for rational thinking, Simon continues]. . . the first consequence of the principle of bounded rationality is that the intended rationality of an actor requires him to construct a simplified model of the real situation in order to deal with it. He behaves rationally with respect to this model, and such behavior is not even approximately optimal with respect to the real world. To predict his behavior we must understand the way in which this simplified model is constructed, and its construction will certainly be related to his psychological properties as a perceiving, thinking, and learning animal (Simon, 1957; slightly adapted from Slovic, 1972).

Thus, an understanding of how teachers cognitively construct the reality of teaching and learning remains central to the achievement of NIE's overall goal of developing the means to improve the provision, maintenance, and utilization of high quality teaching personnel. A teacher may possess the full range of relevant instructional skills, but if he is unable to diagnose situations in which a particular set of those skills is needed, the skills alone will be insufficient. Similarly, intelligent application of the methods of behavior analysis and modification is contingent upon accurate perceptions of student behavior, and upon warranted judgments and interpretations of its meaning. Recommendations of new personnel roles for teachers, or new patterns of staffing and differentiation of responsibilities must be consistent with the information-processing capacities, beliefs, and motives of teachers, or at least with the likelihood of promoting the necessary cognitive characteristics through education and training. These are but a few examples of how a better understanding of the teacher's mental life contributes to the achievement of goals directly addressed by other panels of this conference.

Concerns of This Panel

The observations which follow are presented to identify several ways in which the concerns of this panel can be distinguished. Unlike most other panels of the conference, this one does not represent an existing single community of scholarly interest. Rather, the panel consisted of individuals with widely varying theoretical and methodological orientations, even though it also shared a sense of the proper goals of research on teaching. The Panel had a commitment to understanding the ways in which teachers cope with the demands of classroom life, the circumstances in which these copings lead to successful teaching and learning, and the conditions under which they become maladaptive. It also had a commitment to view the teacher as agent, rather than as a passive employer of teaching skills or techniques, a marginal operator in a complex system of technology, or a set of personality traits and aptitude measures.

The Panel was oriented toward the teacher as clinician, not only in the sense of someone diagnosing specific forms of learning dysfunction or pathology and prescribing particular remedies, but more broadly as an individual responsible for (a) aggregating and making

sense out of an incredible diversity of information sources about individual students and the class collectively; (b) bringing to bear a growing body of empirical and theoretical work constituting the research literature of education; somehow (c) combining all that information with the teacher's own expectations, attitudes, beliefs, purposes . . . and (d) having to respond, make judgments, render decisions, reflect, and regroup to begin again. The actual ratio of reflection to reflex in teaching is itself an important subject for study, both in terms of how teaching currently occurs and in terms of the potential limits of change. Similarly, one must study the degree of flexibility one ought to expect from teachers in shifting from one mode of coping to another, or from a set of expectations once developed regarding a group of youngsters to a modified and more warranted set.

With regard to method, the Panel respected the teacher's self reports as an important (though typically not sufficient) source of data. Whether the teacher is treated as the ubiquitous informant of anthropological inquiry, or the introspecting problem solver of information-processing research, or the interviewed (or questionnaired) holder of attitudes and beliefs of the social psychologist, the panelists took seriously the value of the teacher's own description of how he or she constructs the reality of his classroom, of what was done and why, of who the students are, and how he or she feels about them.

The Panel combined a concern for the human problems of teaching and being a teacher with a commitment to whatever forms of disciplined inquiry seem appropriate to the research problem and educational setting under investigation. The Panel represented a wide set of methodological orientations: anthropological observations in natural settings; mixtures of anthropological and socio-psychological observations and codings of behavior in natural settings; experimental psychological investigations; mathematical modeling of behavior and information processing; clinical interviewing; and use of contrived non-natural settings via simulation or microteaching.

The Panel also employed a variety of theoretical stances that translate into contrasting metaphors for looking at "the teacher as . . ."--the teacher as diagnostician, as labeler, as self-fulfilling prophet, as decision maker, as explainer, as attributor, and many more.

Finally, Panel participants did not perceive their work as related only to educational settings organized the way schools are typically found today. Whether education proceeds according to Individually Prescribed Instruction (IPI), computer managed instruction (CMI), Program for Learning According to Needs (PLAN), or Mastery Learning; whether it goes on in pre-schools, free schools or no schools; as long as a human teacher plays a central role in making the process work, an understanding of how that teacher thinks and how that thinking can be helped to function more effectively will remain an important item for any agenda of research on teaching.

CONCEPTUAL OVERVIEW

A Conceptual Model for Clinical Information Processing in Teaching

The Panel first developed a shared model of the domain of processes and phenomena under discussion, however gross and oversimplified. Figure 1 presents this general model, whose very simplicity permitted fruitful dialogue among theoreticians of different kinds.

The model posits four general categories of variables whose characteristics and functional interrelationships form the subject-matter of this problem area of research on teaching. The representation is clearly in the form of a circle, indicating that no set of variables can be treated as ultimate causes, antecedents, or determinants of the others. Rather, one can enter the model at any point, treating those variables as independent relative to the others. In order to be properly within the purview of this Panel's concerns, a research program must deal with the cognitive processes of teachers, either as independent, intervening, or dependent variables.

At the left of the diagram are the variables called Antecedents of Processes. These variables influence the ways teachers think and act as the determinants of cognitive processes. They are classified in two rough categories: internal and external antecedents. The internal antecedents include such variables as teacher beliefs, cognitive structure or styles, teacher volition and intentionality (purposes, goals, etc.), knowledge of subject matter, and the like. As with each of the other elements in the model, these are only examples. Many more could be listed and investigated.

The external antecedents include the variety of variables that serve as 'cues' to the teacher. These include student behavior, student characteristics (sex, race, size, appearance, numbers), student records (including achievement, grades, measured aptitudes, IQ, family background, attendance, previous behavioral problems), and the informal information networks through which teachers typically communicate. In addition, the external antecedents include the variety of organizational, structural, and role prescriptive variables in any teaching situation--variables that contribute to the definition of a teacher's responsibilities

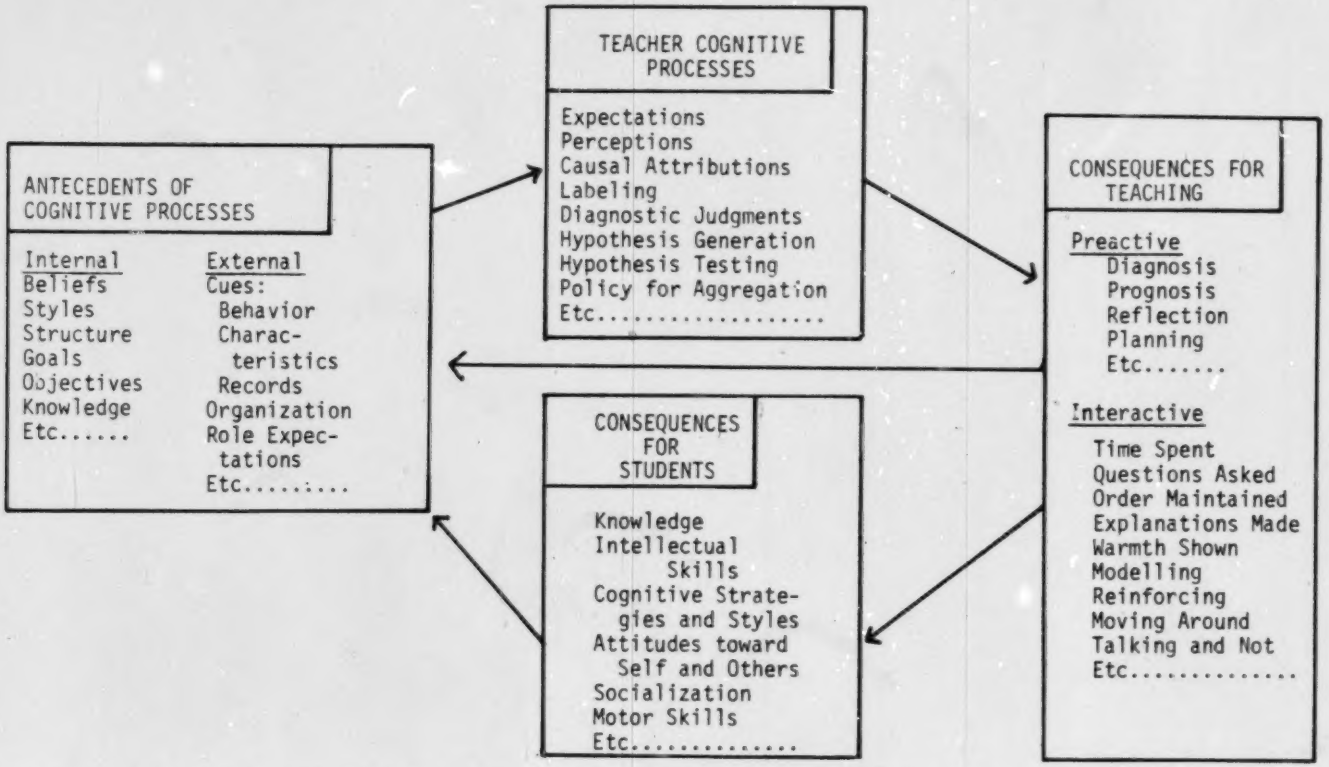


Figure 6.1 A General Conceptual Model for Clinical Information Processing in Teaching and Learning.

and the expectations held for his behavior. These variables include particulars of how the school is organized for instruction, the ways in which records are kept and used (if at all), patterns of in-service education, and the like. All these antecedents are seen as influencing the ways in which teachers think about their teaching.

The Cognitive Processes of Teachers constitute the second major set of variables in the model. The panelists frequently disagreed on the terms for characterizing these variables and on the underlying theoretical models in which those terms are embedded. Examples of such processes include expectations, causal attributions, labeling, person perception, diagnostic judgments, hypothesis generation and hypothesis testing. The choice of terms will reflect an interest in particular aspects of process, a commitment to specific types of theory, or a combination of the two. Concern for the characteristics of those cognitive processes, their antecedents and consequences for teaching and learning, defines the problem area of this Panel.

The third element in the model is Consequences for Teaching. This set of variables includes the many aspects of teacher performance that are in large measure determined by how teachers think. We can, following Jackson (1968), distinguish between two major areas of teacher performances: preactive and interactive. The preactive phase takes place in the "empty classroom," as the teacher recalls what has happened in the class, reviews student work, deliberates about alternatives, lays plans for the future, and engages in all those other crucial activities that involve no direct teacher-pupil interaction. The Panel often found it useful to distinguish among three types of preactive thinking--diagnostic, where the teacher looks backward and attempts to make judgments about events that have already taken place; prognostic, in which the teacher looks forward, attempting to predict, plan, anticipate, practically to prophesy; and reflective, in which the teacher's own actions, motives, and reactions become the subject of his or her deliberations and, perhaps, a powerful vehicle for increased self-awareness and planned change.

The interactive phase of teaching takes place in the fully populated classroom, whether inhabited by a single pupil or a number of them. It is in the interactive phase that we encounter many of the well-studied variables of research on teaching. These include time spent with individual pupils, amount and type of questions asked, warmth, enthusiasm, tactics of classroom organization and management, patterns of reward and punishment, and specific teaching acts such as explaining or modeling. If we conceive of teaching in terms of a diagnostic-prescriptive model, our studies would relate the cognitive processes involved in rendering diagnostic judgments and selecting among alternative programs of action, relating those in turn to variables of teacher performance. Ultimately, however, those categories of teacher performance must be related to their influence on student outcomes, which constitute our fourth set of variables.

Consequences for Students include the full range of outcomes, intellectual, emotional, or motor, which are ostensibly influenced by teacher performance. They involve what students know, how they come to know new things, and their feelings about themselves and about the causes of their own behavior. Examination of the particular research programs proposed for this problem area makes it clear that the range of student outcomes of interest to the Panel was broad, as befits a panel composed of educators, sociologists, psychologists, and anthropologists.

Completing the circle, the model shows that the student outcomes themselves become new cues which serve as inputs to teacher cognitions. Thus, the consequences become antecedents. Similarly, the reflective phase of preactive teaching can result in changes in the internal antecedents of teacher cognitions. These are two examples of ways in which different elements in the model become causal in relation to others. One can thus easily imagine productive lines of inquiry focusing on contrasting pieces of the model, so long as the cognitive process variables become involved at some point.

Problems of Teaching: An Information Processing View

The foregoing conceptual model is not, however, the only perspective from which one can view clinical information-processing in teachers. Standing alone it remains a rather sterile source for research ideas. An additional orientation is necessary.

The Panel considered carefully the range of problems teachers encounter (or are perceived to have). These problems can be roughly classified as "cognitive" or "information processing." It was by reflecting on the conceptual model from the vantage point of these problems of teaching that the Panel generated its particular approaches and programs. These lengthy discussions are summarized briefly here. Their consequences, in the form of approaches and programs, will be presented below in greater detail.

The field of problems was divided into two categories: those perceived by outside observers or critics, and those perceived by the teacher.

The outside observer sees as problems the consistency, persistence, and accuracy of teachers, is concerned about what factors affect these qualities, and asks:

- Why do teachers sometimes behave in ways that do not match their own beliefs or the stated goals of the schools in which they work?
- What motivations and rewards enable a teacher to exert a continuous effort to educate children?

- What contributes to a teacher's ability to assess pupil errors correctly, perceive positive qualities in pupils, and accurately inform pupils?

The teacher sees as problems his or her alternatives, constraints, and feedback, is concerned about why an educator's life is so fraught with uncertainty, and asks:

- How many alternatives can I consider before making a decision?
- What are the real limits to the actions I can take, and what will happen if I overstep them?
- How can I know whether my information and inferences are valid, and how can I ever see the real effects of my teaching?

Figure 2 represents the relationship between problem perspectives and the conceptual model of teacher cognitive functioning from which our approaches emerged.

This general model was essentially non-controversial. But moving from that representation to definition of a set of research approaches, within which programs of research could be defined, presented difficulties. These difficulties were more often pragmatic than theoretical. We turn now to the problem of defining Approaches.

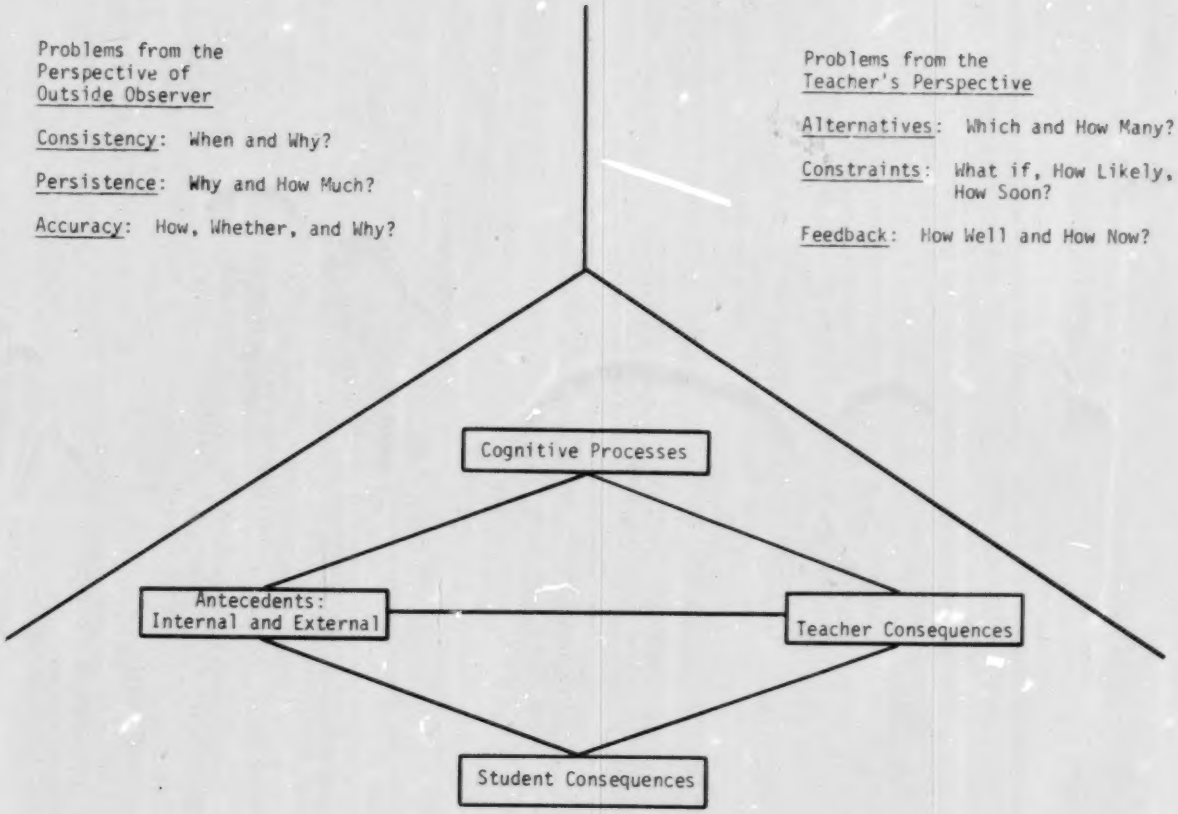


Figure 6.2 Problems in Teaching as Seen by Outside Observers and Teachers.

THE DERIVATION OF APPROACHES AND PROGRAMS

Rationale for Approaches Selected

The focal point of all research programs in this problem area remains cognitive functioning, or the mental life of the teacher. The five substantive research approaches (leaving out for the moment the method and theory development approaches) define contrasting families of problems or topics for study. All relate to two basic questions: (a) How do the ways teachers think--about themselves, their work, their students, their subject matters and materials, the settings in which they operate and the alternatives which they consider--affect the nature and quality of their teaching and students' learning? (b) What are the ways in which the quality of these cognitive processes can be enhanced, whether through teacher selection, teacher preparation (in-service or pre-service), restructuring of schooling, development of teaching aids (technological, human, or both) or some combination of these?

The Panel's representation of the research approaches and their interrelationships is shown in Figure 3. We now proceed to define the several approaches and the general questions with which each deals. This section will be followed by a discussion of the nature of a research program within an approach and a listing of the research programs so defined.

Approach 6.1 -- Examine the Clinical Act of Teaching: Diagnostic Judgment and Decision Making in the Events of Teaching.

Central to the problem area is the view of the teacher as a clinician, actively processing information from many sources in order to render judgments and make decisions. These activities take place both in the "empty classroom," during the preactive phases of teaching, and interactively, in the real-time transactions between teacher and students In this clinical model of teaching, the teacher is seen performing a professional role quite parallel to those of physicians, lawyers, stockbrokers, military strategists (William James likened teaching to waging war), and other practitioners. The model focuses the researcher's attention on the manner in which teachers process information. They employ that information to reach diagnostic judgments and make prescriptive decisions as they attempt to respond appropriately to each student's learning difficulties and strengths. The activities surrounding teaching as diagnostic problem solving and prescriptive decision making form the core of research in this area Hence, this approach is considered first, and it includes the largest number of currently defined research programs.

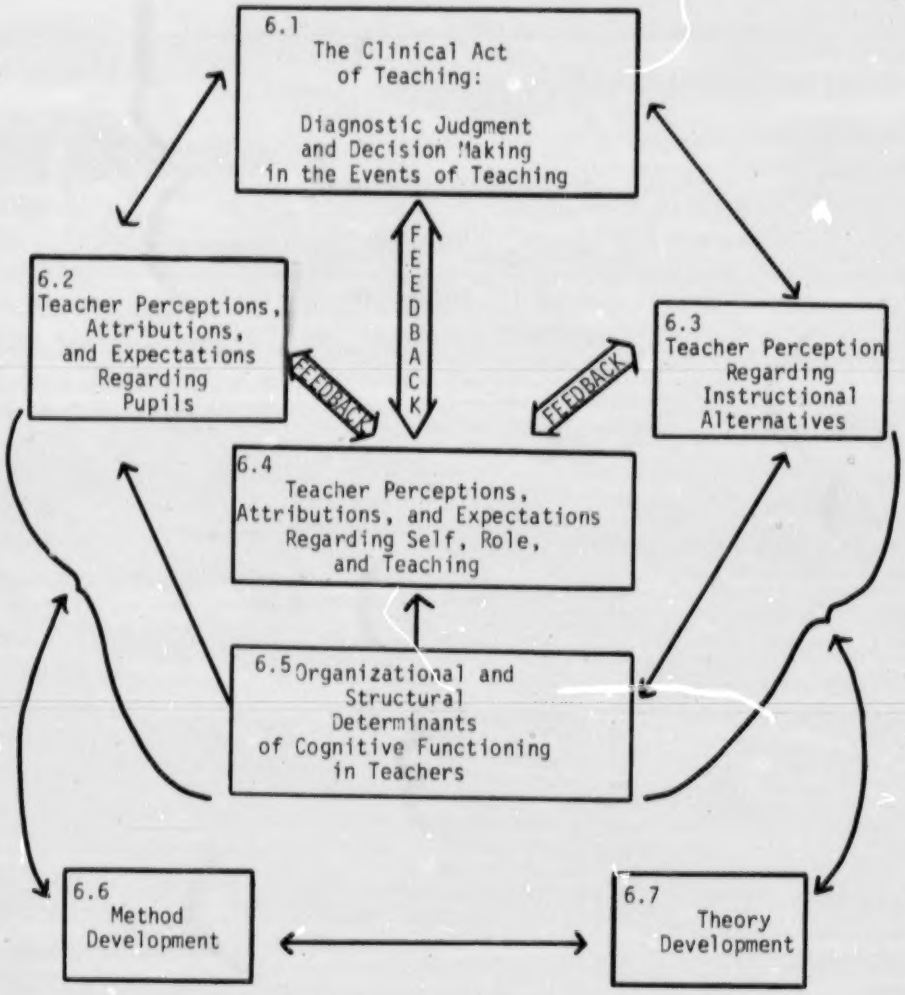


Figure 6.3. Approaches to the Study of Teaching as Clinical Information Processing.

Approach 6.2 -- Study Teachers' Perceptions, Attributions, and Expectations of Students.

Whereas diagnostic teaching per se revolves around specific instructional encounters and situations, there are other kinds of judgments teachers typically make which are more global, general, or ascriptive. Such judgments ("bright," "smart-aleck," "lucky," "street blood," "school blood," "promising") may constitute an inference about the causes of the pupil's behavior, may concern a characterization of his general personality, or may be an implicit estimate of the likelihood of his future success. The judgments may be directed at specific students or generalized across groups of students. Programs of research directed at understanding these judgments--how they are formed, and what consequences they hold for teaching and learning--form Approach 6.2. Clearly, a teacher's general assessment of a pupil's characteristics and the same teacher's diagnostic and prescriptive responses to that pupil's specific learning performance will interact in potentially significant ways. Thus, a particular research project might well cut across objectives in two research approaches.

Approach 6.3 -- Study Teachers' Cognitive Processes in Selecting Among Instructional and Organizational Alternatives.

In addition to making global judgments about pupils, teachers make general assessments about the organization of classrooms (and themselves) for learning. Teachers make judgments regarding grouping of students, arrangement of physical settings, selection of instructional materials and methods, topics and objectives, which are of a different order from their perceptions of pupils, but which affect their diagnostic decisions regarding individual pupils and groups of pupils. These judgments relate to the teaching of something, somewhere, sometime, or somehow--rather than teaching somebody. Research on the antecedents and consequences of these types of teacher thinking constitutes Approach 6.3.

Approach 6.4 -- Study Teacher Perceptions of Self, Role, and Teaching: Reflection and Feedback.

The next approach focuses upon the teacher himself, both as a holder of general beliefs, attitudes, motives, and commitments toward a variety of individuals, objects, and institutions; and the teacher as an object of his own cognitions, aware of himself, his behavior and motives, and capable of modifying his thoughts and actions on the basis of feedback and reflection. Approach 6.4 deals with this highly important area, in which may lie some of the keys to continuous teacher self-renewal and revised perceptions of pupils and instructional tactics.

Approach 6.5 -- Study the Organizational and Structural Determinants of Cognitive Functioning in Teachers.

The mental life of teachers, whether occupied with thoughts of teaching acts [6.1], learner characteristics [6.2], organizing and planning for teaching [6.3], or reflecting on oneself and one's own functioning [6.4], does not occur in a vacuum. Indeed, teachers' thinking takes place in a matrix of organizational and structural circumstances. This matrix includes variations such as those between open classroom and traditional settings, individualized teaching systems and grouped systems, graded and ungraded classrooms, 15 pupils and 40 pupils,

team teaching and individually managed classrooms, and differentiated staffing and traditional staffing. All these variations doubtless affect the cognitive functioning of teachers. The programs of research in Approach 6.5 address the effects of such variables on the mental life of the teacher. Such organizational or technological changes not only influence how teachers think and what they think about. These innovations must also be consistent with the realities of how teachers think and feel. Thus, many millions of dollars worth of biomedical computing systems--hardware and software--are lying underused, if used at all, in hospitals and major medical centers across the country, because no one bothered to investigate the ways physicians and other health personnel really thought about and did their work. The systems introduced may have reflected the latest view of how computers ought to perform. Unfortunately, those who introduced these systems ignored the cognitive and attitudinal realities of the prospective users. We should avoid a similar fate in attempts to reform teaching.

Approaches 6.6 and 6.7 do not deal with specific substantive problems within the problem area. Rather, they cut across topical concerns and deal with problems of method and theory common to all approaches or necessary for relating approaches coherently with one another.

Approach 6.6 -- Develop Method for Research on Teaching as Clinical Information Processing.

Much of the research described in the above approaches differs in emphasis and theoretical orientation from both the neo-behaviorist experimental tradition and the psychometric tradition that have formed the mainstreams of psychological research on American education. Therefore, neither the experimental design models of Campbell and Stanley (and their many variants) nor the classical methods of measurement are sufficient in themselves for research in these areas. Approach 6.6 includes a program of research aimed at refining and improving methods of systematic introspection or thinking aloud, decision analysis, anthropological studies of teaching, analysis and coding of complex descriptive protocols, and the like.

Approach 6.7 -- Develop Theory Concerning Teaching as Clinical Information Processing.

Progress in any field of research is likely to be made most easily when clear theoretical formulations are available or can be readily produced. In the absense of theory, constructs refuse to stay put, distinction blur, and discussions repeat themselves endlessly. The problems with which this Panel is concerned will not be solved by more programs of empirical research alone. Serious efforts are needed in theory development in this field, through support of individual theoreticians attempting to formulate parts of the problem area, groups of investigators attempting theoretical rapprochements across formulations, or short-term conferences to bring together representatives of theoretical positions that would otherwise be unlikely to communicate. In some ways, the Panel's discussions represented this third approach. Such an effort is of particular importance in this problem area, since so many types of theory are already brought to bear on cognitive functioning in teachers, yet each is but a partial theory when compared to the full span of cognitive functioning in which teachers engage. The report of Panel 10 on Theory Development contains several suggestions which would be quite fruitfully pursued within the problem area of teaching as clinical information processing.

General Statement of Linkages to Other Panels

The research area represented by Panel 6 intersects generally with the concerns of all other panels. To the extent that the teacher is a human being whose actions are, at least in part, influenced by his thoughts and feelings, an examination of the relationships between thought and action in teaching is imperative. We shall briefly describe specific intersections between panel concerns below.

Panels 2-5: Dubbed the training panels, these are concerned with the identifying, inculcating, and sustaining the various skills, strategies, knowledges, behavior patterns and attitudes associated with effective teaching. These panels all propose to prepare teachers to employ certain processes skillfully in situations that call for them. As such they are teaching the management of learning or prescription for teaching--a repertoire of tactics which any teacher must master. Panel 6 typically asks the question, How does a teacher determine which among the impressive arsenal of skills, interaction patterns, behavior analysis strategies or speech patterns he ought to employ, in what sequence and for how long? How does the teacher judge a pupil as being in a state calling for a particular intervention and how does the teacher subsequently assess that the tactic has either succeeded or failed? Thus, we see such processes as judgment, diagnosis, attribution, expectation, and self-perception as necessary concomitants of any approach to teacher preparation that would teach teachers to "prescribe", that is, to manage the learning process. The dangers of prescription without prior diagnosis and continuous monitoring are well recognized.

Do individuals differ in their capabilities for processing information in judgment, aggregating that information into a diagnosis, moving from diagnostic judgment to prescriptive choice of action, reflecting and revising decisions on the basis of feedback, and other processes integral to diagnostic/prescriptive clinical thinking? If so, and if these are demonstrated to be both predictive of desirable teacher performance and reliably measured, our panel's concern intersect with those of Panel 1. Moreover, Panel 1's questions regarding strategies and methods for selecting teachers are methodologically directly parallel to ours regarding teacher selection of actions for teaching pupils--collecting and synthesizing information, etc.

Panels 7 and 8 are dealing with present and projected utilization of teaching personnel in instructional systems. The man-machine systems tradition attests to the importance of designing programs and systems of technology that achieve an optimal fit between man's unique capabilities and severe limitations on the one hand, and the equally massive, but contrasting, limitations of technological systems, on the other. Much of NASA's work reflects that understanding, as do recent developments in biomedical computing engineering.

In addition to man-machine interactions, present and projected utilization procedures involve interpersonal or group interactions. Human thought and feelings are influenced by the structure of the groups or organizations in which problems are solved.

Finally, the panel's area is replete with problems both of method and theory. For this reason, we designated two of our own approaches to deal explicitly with those problems. We view the analysis and integration of the diverse theoretical formulations which constituted Panel 6 as an exciting "strategic research site" for group theory development.

Programs of Research: General Observations and Orienting Questions

For the purposes of this Panel's deliberations, a research program is defined as a stream of inquiry aimed at a linked set of questions -- a set which follows our general conceptual model with respect to any given topic of investigation. That is, whatever approach to research on clinical information processing in teachers is being pursued, and whatever emphasis within that approach has been identified, there are certain general questions which the NIE ought to consider relevant, and which together constitute a research program. These five General Orienting Questions are:

1. What are the varieties of circumstances in which the topic under investigation occurs or is implicated? What are its characteristics? In planning research on teachers' causal ascriptions for pupil behaviors, the question would be phrased, "What are the circumstances under which causal ascriptions are made by teachers and what forms do they take?" This question is abbreviated as What in the program description tables.

2. What are the antecedents or determiners of the events or processes in question? Why do they occur? In the example used above, this line of questioning would ask "Why are such causal ascriptions made? What are the situational and internal antecedents of causal ascriptions in teachers?" This question is abbreviated Why in the tables.

3. How can these processes be modified? Given an understanding of the antecedents of processes or events, how can someone manipulate or influence these antecedents in order to bring about change? In the given example, it would be "How can we influence the causes of causal ascription or the attributional process itself?" This question is abbreviated How.

4. What consequences for teaching and learning flow from these processes or events? For example, what effects on teaching or learning are discernible as a function of differences in patterns of teacher ascriptions of cause? This question is essentially So What.

5. What are the implications of the findings of studies of modifiability for the practical improvement of practice--programs of teacher selection or preparation, changes in the organization or methods of schooling, and the like? These questions of feasibility of translating the results of research into realities of practice are referred to as Now What.

As Table 1 shows, the five orienting questions can be asked for each of the five substantive approaches presented earlier. They are less clearly relevant to Approaches 6.6 and 6.7 on method and theory development. Each program presented below takes its research topic and acquires its programmatic quality as a stream of inquiry through the five general orienting questions. Thus, any given program of research becomes a set of possible linkages and does not necessarily describe the required scope of any individual research project. In fact, it is unlikely that any specific project will carry through an entire stream of inquiry. But anyone who recognizes the linkages can stimulate the pursuit of linked inquiries, even if they are conducted by independent investigators.

Each of the programs is presented below in some detail. The program descriptions supplement the general theoretical introduction provided in the definition of each approach presented earlier.

It is important to note that, as individual programs are described, many of them will appear to cut across more than one approach. There was an initial attempt to prevent that from occurring, but it subsequently became clear that it was inevitable. If approaches represent theoretical formulations and each approach is characterized by a contrasting theoretical position, then any intelligent research program focusing on a significant practical issue will frequently draw upon more than one theoretical explanation of the phenomena under study.

If the approaches represent alternative methods for investigating the phenomena of a field, then either the theoretical or the practical issues of significance will probably cut across more than one approach when the problems are formulated at all comprehensively. If the approaches are themselves families of practical problems in teaching or teacher preparation, then any programs of research which emanate from general theories or methods will necessarily extend across approaches. Thus, it appeared that the most fruitful programs were those most likely to spill over the boundaries of defined approaches and to occupy the interstices.

In keeping with this definition of a research program, the individual approaches and programs will now be presented. It should be emphasized that these are intended to be representative examples, and not exhaustive. At times, a program is listed by name only, as a sort of place-holder, even though the actual program description has not yet been developed.

Table 6.1 General Orienting Questions: The Stream of Inquiry

APPROACHES/	WHAT	WHY Internal/ External	HOW	SO WHAT	NOW WHAT
6.1 The Clinical Act of Teaching: Diagnosis and Prescription in Student Learning					
6.2 Perceptions, Attributions, and Expectations					
6.3 Cognitive Processes in Selecting Among Alternatives in the Organization of Instruction					
6.4 Teacher Perceptions of Self, Role and Teaching; Feedback and Reflection					
6.5 Organizational and Structural Determinants of Cognitive Functioning in Teachers					
6.6 Development of Methods					
6.7 Theory Development					

APPROACH 6.1
EXAMINE THE CLINICAL ACT OF TEACHING

This approach is an outgrowth of several perspectives that have been brought to bear in recent years on questions of problem-solving, decision-making, and judgment. There are two basic strategies employed in such efforts: information-processing analysis and investigations of judgment and decision-making. First, information-processing strategies in the study of human cognitive functioning, as developed by Simon, Newell, and their associates (Simon, 1969; Newell & Simon, 1972) have been a fuitful domain of inquiry. These strategies have been successfully applied to a number of settings--proving mathematical theorems, selecting a chess move, modeling the thought processes of investment trust officers, interpreting psychological tests, and solving neurological problems, among many others. They involve the application of systematic thinking-aloud methods of controlled introspection for the design of computer programs that simulate the thought processes described. The programs test the adequacy of those descriptions in producing the processes and products of interest. Alternatively, many investigators do not use computer simulation as a tactic for expressing and testing a theoretical model and instead prefer English prose for stating the model and human experimentation for testing it.

A second strategy consists of research on judgment and decision making. The language, research methods, and general perspective associated with this strategy suggest not only specific ways of studying teaching, but heuristically useful metaphors as well. Bayesian strategies in decision analysis have been brought to bear on such diverse problems as the gathering of military intelligence and its interpretation, specifying relationships between diagnostic signs and diagnoses, and the general question of human adequacy when functioning as an intuitive statistician, judging likelihoods, judging utilities, or aggregating across both. Regression and ANOVA strategies for the characterization of judges' policies have been applied to the study of clinical psychologists rendering classification decisions, draft boards evaluating conscientious objectors, admissions committees reviewing candidates for graduate school, and radiologists reviewing chest x-rays. Applications of Brunswik's lens model (1955, 1956) have been made to the investigation of labor-management negotiations, policy-community relations, drug effectiveness in clinical trials research, and the form of feedback most useful in assisting learners to modify their policies more effectively.

These two general strategies of research, developed mainly by psychologists, have rarely been employed in studies of teaching. However, their potential relevance is currently being explored (Shulman & Elstein, in press).

Much research in this approach has emphasized the description and characterization of current practice in teaching. This emphasis occurs for two reasons. First, any eventual attempts to change ongoing systems of instruction in the schools must be predicated on an a priori understanding of the practice to be changed.

Second, and even more important, is the recognition that gifted practitioners are capable of performances which our best theories are not yet capable of explaining, much less generating or predicting. Hence, an essential starting point for many studies is the intensive, systematic investigation of the diagnostic and prescriptive thinking of practitioners, in order to elucidate, or make public and formal, the typically intuitive strategies employed by gifted teachers.

Program 6.1.1: Analyze the Diagnostic Process in Teaching

It has recently become evident that diagnostic processes and strategies, once thought to be unobservable, can be made explicit. The development of statistical methods such as the "lens model" enables one to specify the cues and their relative weights for the diagnostician. Similarly, process tracing techinques permit the building of detailed sequential models of a diagnostician's processes. These types of models can be extremely valuable in providing the diagnostician with insight into his own processes or for communicating expertise from master diagnostician to student diagnostician. In some cases (e.g., large-scale screening), an expert's diagnostic probing can be captured and applied systematically by computer, resulting in considerable savings of time, effort, and money. A great deal is known about modeling diagnostic processes. This work was reviewed by Slovic and Lichtenstein (1971) and by Shulman and Elstein (in press). Although some methodological problems exist (e.g., difficulties in determining weights for interrelated cues and the lack of standardized procedures for distilling process models from introspection), these are not insurmountable. It would be desirable to provide research support to investigators interested in improving these methodologies.

Research should be conducted in four areas. First, tasks in need of analysis must be specified. These may include determination of reading difficulties or prescription of treatment for reading disability. Another might be the assignment of students to differential curriculum programs. For relevant tasks, the policies employed by experts and students should be described. Some diagnostic tasks may be less amenable to analysis than others. For those that can be analyzed, we can assess the degree to which the teacher is integrating cues in a manner that is true to his desires or to established standards of procedure. The analysis may show that diagnosticians differ in important ways from one another, that they apply their policies inconsistently (i.e., with much random error) or that they fail to weight cues as they (or the experts) prescribe. If such discrepancies and inadequacies exist, technologies for aiding the diagnostic process (e.g., Hammond's computer graphics techniques, 1971) can be examined for their efficacy. For example, discrepancies between ideal or desired weighting policies and actual policies can be displayed for the teacher-judge to facilitate convergence. A related question concerns transfer of training. If a teacher is trained via lens model feedback to give greater salience to a particular cue, will this cue be weighted more in related decisions outside the specific context of training? Another use of lens model procedures is to focus discussion among teachers as to the salient cues and weighting policies.

Table 6.2 on the facing page applies the format of Table 6.1 in suggesting the orienting questions to be asked specific to the above program. (Subsequent Tables 6.3 through 6.9 will similarly pose the corresponding questions for selected other programs.)

Table 6.2 Analyzing the Diagnostic Process in Program 6.1.1.

What are Information Processing Demands and Activities? What?	Antecedents and Determinants Why?	What are the Consequences? So What?	What are the Possible Changes? How?	What are Feasible Changes? Now What?
Techniques are available for making explicit the processes underlying diagnostic inferences. These techniques provide answers to such questions as: What are the cues and relative weights? What are the sequential processes and algorithms? Do teachers actually employ the cues and weights that their values and beliefs suggest they should be employing? Can teachers accurately specify their judgmental policies?	If teachers' policies are not in tune with their subjective perceptions or desired policies or the policies they had been trained to employ, how do these discrepancies come about?	Can specific cue utilization patterns be associated with good and poor diagnosticians? Can these techniques be utilized to facilitate group discussion among teachers about relevant aspects of a diagnostic problem?	What form of feedback or training will speed the teaching of diagnostic skills and make diagnoses more valid? Does training via lens model feedback generalize to "in vivo" behaviors?	

Program 6.1.2: Examine the Pervasiveness of Bias in the Diagnostic Inferences of Teachers.

Recent psychological research has identified a number of logical inadequacies in human inferential judgments. For example, chance fluctuations likely to have stemmed from statistical regression are rarely recognized as such but, instead, are attributed to substantive changes in behavior. In some situations, evaluation of evidence is unduly conservative; that is, the judges fail to extract all the certainty inherent in evidence. In other situations, judges typically overweight the impact of small samples of data. It is known that subtle and presumably unimportant changes in the format of a judgmental response (e.g., whether it is a category rating or a magnitude estimate) can have large effects on the resultant evaluations. In many circumstances, information-processing demands can be shown to lead the judge to produce responses that are inconsistent with his underlying values and beliefs. We need to determine the degree to which these phenomena, isolated in other contexts, affect teacher judgments. The recent literature on this topic has been reviewed and summarized by Slovic and Lichtenstein (1971) and Slovic (1972).

This program of research contains four facets: (a) the need to determine which biases and deficiencies are present in the inferences of teachers; (b) if such biases are found, the need to examine their cognitive and situational determinants; (c) the need to examine the potential detrimental effects of such biases on the educational process; (d) if such detrimental effects exist, the need to explore potential techniques for reducing them. These techniques can involve informing teachers about bias, restructuring the judgmental task, or providing analytic computer aids to facilitate the decision.

Table 6.3 Examining the Pervasiveness of Bias in the Diagnostic Inferences of Teachers in Program 6.1.2.

What are Information Processing Demands and Activities? What?	Antecedents and Determinants Why?	What are the Consequences? So What?	What are the Possible Changes? How?	What are Feasible Changes? Now What?
Many specific biases and deficiencies of judgment have been isolated by judgment researchers. It is important to determine which of these deficiencies are prevalent in teachers' judgments and to identify which cognitive activities of the teacher are most affected.	What factors in the intellectual makeup of man and in his environment lead to these pervasive deficiencies? Example: Simon's work on limitations of memory which illuminates the phenomenon of "chunking".	To what extent do observed judgmental deficiencies hinder teacher-pupil interaction or otherwise disrupt the learning process?	Can observed deficiencies be remedied by (a) informing (warning) teachers about them? (b) restricting the task environment to reduce demands on teachers? (c) developing decision aids to assist teachers? Does knowledge and training transfer across tasks?	

Program 6.1.3: Examine Teachers' Diagnoses of Pupils in the Preactive Phase of Teaching.

Teacher planning is an activity that could contribute to improvement of teaching effectiveness if teaching is indeed improvable as a result of teacher thought. Very little is known about how teachers actually collect and process information in diagnosing pupils and planning for further instruction. We need to know whether interactive and preactive diagnosis is indeed different, and whether training can improve the diagnostic process.

Previous research related to this program includes that reported by Jackson (1968) in his Life in Classrooms, which was concerned with the identification of differences between preactive and interactive decision-making. Two related studies were conducted by Shulman; one was concerned with teachers decision-making in simulated settings (Shulman, Loupe & Piper, 1968), and another with the diagnostic processes of physicians (Elstein, et.al., 1972). Possible training procedures were explicated by Morine (1973b).

It is assumed that the preactive phase of teaching provides teachers with an opportunity for more controlled, rational thought and decision making than does the interactive phase of teaching. But it is not known in fact whether teachers take advantage of this presumed opportunity to consider and weigh alternatives.

The purpose of this program is to determine what types of diagnoses teachers make in preactive settings, what types of information they use, what types of decisions or actions they take as a result, what types of training lead teachers to consider alternatives and operate in a hypothetico-deductive mode of thought in pupil diagnosis, what effects different school organizations have on diagnosis, information, and action, and whether real differences exist between interactive and preactive diagnosis by teachers.

The research procedure suggested by the Panel would be to use simulation to identify types and amounts of information used by teachers, types of diagnoses, and alternatives considered. This information would be supplemented by interviews with teachers in natural settings.

Table 6.4 Examining Teachers' Diagnoses in the Preactive Phase of Teaching in Program 6.1.3.

What are Information Processing Demands and Activities? What?	Antecedents and Determinants Why?	What are the Consequences? So What?	What are the Possible Changes? How?	What are Feasible Changes? Now What?
What types of diagnoses do teachers make about pupils in preactive settings? How many alternative diagnoses are considered? How accurate are the diagnoses? Is there a relationship between the number of alternative diagnoses considered and accuracy of diagnoses? Is there a difference between preactive and interactive settings in the number of alternatives considered, and in the accuracy, types, and frequency of diagnoses?	What types of information do teachers consider in making preactive diagnoses? Do they relate different items of information and synthesize them or weigh and select them? Are different uses of information (of the above types) differentially effective in making accurate diagnoses? Does the amount (or variety) of information used for diagnoses differ in preactive and interactive settings? Do teachers seek information to test previous decisions? Do they seek supportive or conflicting evidence?	What types of teacher decisions follow from preactive diagnoses? From the number of alternative decisions considered? From the length of time judgment is suspended? From the types of information considered? Is there a relationship between frequency of teacher diagnosis and pupil outcomes?	What types of training (e.g., simulation) operate to increase the number of alternative diagnoses, number of types of information considered, number of alternative decisions (actions) considered? What is the effect of different school organizations (e.g., team teaching, individual instruction, self-contained classroom) on types of diagnoses, types of information used, types of decisions, and number of alternatives considered?	

Program 6.1.4: Examine Teachers' Diagnoses of Pupils in the Interactive Phase of Teaching.

Several theories deal with teachers' diagnoses of pupils in the interactive phases of teaching. The major theories related to diagnosis of pupils in relation to concept learning grow out of the work of Ausubel (1963), Bruner, et.al., (1956), and Taba (1963), all of whom identified types of diagnoses related to their own approach to the study of concept learning. Hunt's work on matching models (1971) identified some pupil cues that teachers can and do attend to. Joyce and Weil (1972) identified general patterns of teaching behavior associated with particular instructional models and demonstrated that training in models of teaching leads to variation in teaching behavior. Flanders (1970) found that variation in teaching behavior in a general sense, i.e., from lesson to lesson, is associated with improved pupil achievement and attitudes, and that using interaction analysis data as feedback results in behavior changes.

It is assumed that interactive diagnosis involves a *different* kind of cognitive problem for teachers than preactive diagnosis, because decisions must be almost instantaneous and the amount of information impinging upon the teacher is quite large. The purpose of this program is to determine the numbers and types of diagnoses teachers make in interactive settings; the numbers and types of cues teachers use to make diagnoses; the types of patterns of teaching behavior (or typical prescriptions) associated with each type of diagnosis; the effect of alternative instructional models on variations in types of diagnosis, types of cues, and patterns of teaching behavior; the effect of focusing teacher attention on particular student characteristics on variation in types of diagnosis, types of cues, and patterns of teaching behavior; the effect of such variation in interactive diagnosis and prescription on pupil learning, both general learning and "model-relevant" learning.

This program is related to the program on pupil diagnosis in preactive settings, the program on analyzing the diagnostic process, and the program on the diagnostic teaching of subject areas under the problem area of teaching as clinical information processing. It is also related to the problem areas of teaching as skill performance (Panel 4) and teaching as human interaction (Panel 2).

A variety of methods of investigation could be employed, including observation and coding of teacher and pupil behavior in standardized teaching situations; stimulated teacher recall of interactive diagnoses; teacher sorting of pupils (concept formation task) as a means of identifying the cues teachers attend to; training to increase the teacher's repertoire of behaviors; and measurement of general and "model-relevant" pupil learning.

Table 6.5 Examining Teachers' Diagnoses of Pupils in the Interactive Phase of Teaching as in Program 6.1.4.

What are Information Processing Demands and Activities? What?	Antecedents and Determinants Why?	What are the Consequences? So What?	What are the Possible Changes? How?	What are Feasible Changes? Now What?
What types of diagnoses do teachers make about pupils during classroom interaction (cognitive/social, group/individual, etc.)? How many alternative diagnoses are considered? What types of possible diagnoses are ignored or discarded? How accurate are the diagnoses? Is there a relationship between the number of alternative diagnoses considered and the accuracy of diagnoses?	What types of cues are used by teachers to make diagnoses during interaction? Do the types of diagnoses vary as the instructional objective or strategy (model) varies? Do the types of cues used vary as the instructional objective or strategy (model) varies? What types of cues are ignored? Do these vary with the instructional model? Does accuracy of diagnosis vary with the number of cues attended to?	What types of teacher behavior follow particular types of diagnoses? Do teachers have a varied repertoire of behavior (prescriptions) for a given diagnosis? ...for different diagnoses? ...for different instructional strategies (models)? How often do teachers change lesson plans as a result of interactive diagnoses? Is there a relationship between frequency of lesson adaptations resulting from interactive diagnoses and pupil outcomes specific to lesson objectives (model-relevant outcomes)?	Does the introduction of teaching models in and of itself alter the types of diagnoses teachers make, the types of cues they attend to, and the types of teacher behavior (prescriptions) they exhibit in response to pupils? Does training in identification of particular student characteristics in and of itself alter the types of diagnoses, cues, and "prescriptions" teachers make? Does systematic feedback on cues and "prescriptions" alter the types and numbers of diagnoses made? Does training in teaching models interact with training in identification of student characteristics in effect on accuracy, variation and adaptation of teacher diagnoses and prescription in interactive settings?	

Program 6.1.5: Examine Diagnostic Teaching in the Subject Area of Reading.

Whereas other programs in Approach 6.1 examine processes of teachers' diagnostic and prescriptive thinking in general, it is also necessary to conduct studies of such thinking in the important subject areas. It is abundantly clear that subject matters differ enormously in their structure and content and the manner in which they are typically taught. Thus, the diagnostic teaching of mathematics will differ from the diagnostic teaching of social studies, in large measure because the characteristics of those two domains differ markedly. For example, treating topics in mathematics as learning hierarchies of skills and their prerequisites is well-justified and implies clear consequences for diagnostic teaching. On the other hand, topics in social studies are rarely structured hierarchically; hence, the problems of diagnostic teaching will be different. In general, it will be insufficient to prepare teachers as diagnosticians and decision makers, per se; they must learn to match their strategies of *judgment* and prescription to the specific characteristics of the subject area in which they are working. (Shulman, 1974).

There is a growing literature supporting the notions of subject-matter specificity in the structures of knowledge and forms of learning; it also supports the problem- or case-specificity of processes of judgment and decision-making. Although the "psychology of school subjects" originally enjoyed its greatest popularity in the 20s and 30s, there is a growing sense among educational theorists that our quest for universal, subject-independent, theories of learning and instruction has been hampered by ignoring the very real differences among the subject-matter areas to be learned. Moreover, most teacher preparation maintains, and appropriately so, separate courses for teaching methods in subject areas. This also reflects an understanding, typically not well exploited in the methods courses, that the intelligent diagnostic teaching of any subject requires that judgments be integrated regarding both student characteristics and properties of the subject to be learned. Aggregating these judgments into a coordinated teaching plan requires careful analysis.

The questions to which this program would be addressed are stated in the following paragraphs:

What? Why? What cues (as well as concepts, beliefs, etc.) are employed by teachers to classify students as good or poor readers? Which are most heavily weighted, and how are they aggregated? In general, what kinds of diagnostic judgments are made by teachers of reading, and what sorts of evidence (e.g., decoding skills, comprehension, enjoyment or interest, reading speed, 'behavior' while reading, reading achievement scores) are employed as a bas's for those judgments? Interactively, how many levels of diagnostic judgment are encountered simultaneously?

So What? How are carious patterns of information processing--policies of cue utilization, approaches to hypothesis generation and testing, etc.--related to a wide range of student outcomes?

How? What policies, diagnostic processes, and categories of analysis are characteristic of reading teachers who are identified as outstanding diagnosticians? How do they process information, collect and interpret data, generate and test hypotheses, revise judgments, etc.?

Now What? What pragmatic implications can be drawn from a better understanding of diagnostic reading instruction for better pre-service preparation of teachers? For inservice skill development? For the development of decision aids for gathering information, generating diagnostic hypotheses, aggregating information across multiple information sources, and suggesting decision plans? For the development of techniques for providing feedback to teachers of reading? For the preparation of para-professional teacher aides, pupil-peer tutors, etc?

Program 6.1.6: Examine Ways of Using Information About Students in Arriving at Instructional Judgments.

Teachers are required to make judgments about the state of the learner in order to decide on instructional moves. Currently we do not know what cues are used by teachers during the course of instruction to arrive at these judgments.

Some data indicate that teachers use limited sources of information to make preactive instructional decisions. For example, information concerning previous achievement, IQ, and personality variables can be used by teachers to judge the likelihood that a student will be an instructional problem. We currently have no data, however, regarding which behavioral cues from students are used by teachers to make interactive judgments leading to the modulation of teacher behavior during the course of instruction. Thus, this program would identify constituent antecedent elements in the teacher's judgmental process leading to instructional consequences. Information will be gathered identifying critical student antecedents leading to these judgments.

APPROACH 6.2
EXAMINE THE PERCEPTIONS, ATTRIBUTIONS, AND EXPECTATIONS OF TEACHERS.

This approach also represents a melding (or at least a juxtaposition) of several distinct theoretical perspectives, not only from psychology, but from sociology and anthropology as well.

The oldest area of research has been that of social or person perception. Social perceptions and interactions are seen as conditioned, in part by role definitions and expectations. Thus, the concept of the "self-fulfilling prophecy" was invented by a sociologist, Robert Merton, to characterize some of the complex relationships among expectations, motivations, and behavior. There is a vast literature in person perception, though the general field has enjoyed somewhat lessened popularity among educational researchers in recent years.

The most active field of research in this domain has concerned itself with teachers' expectations -- their roots and their consequences for student performance and self-perceptions. As many of the scholars writing in this field have observed, expectations are a normal, indispensable feature of human cognitive functioning. Without them, the strains of constant information processing would rapidly overwhelm us. In fact, it is because the world so typically corresponds with our expectations of it that survival is possible. We employ these expectations to interpret or evaluate the meaning of new information which we receive; to anticipate the form that incoming information will take, hence frequently reducing the need actively to process that information; or to judge the sufficiency of information received in order to render a particular judgment or decision. When these usually adaptive expectations lead to systematic distortions of our perceptions, and cripple our capabilities for making proper use of new information or of making decisions having the greatest utility, those expectations become objects of concern for educational researchers. Such was surely the case with the present generation of investigators stimulated by studies of the 'Pgymalion effect.' A recent book, Teacher-Student Relationships by Brophy and Good (1974), summarized this growing body of research, especially many of the most recent studies which were not subject to the methodological criticisms leveled against the work of Rosenthal and Jacobson (1968).

Studies of attribution grow out of the relatively new field of cognitive psychology of motivation. This research asks how people come to judge the causes of success or failure in themselves and in others. Attribution theory can surely be applied to the investigation of perceived causes of pupil success and failure. The basic question of such research is how causal attributions might influence the rewards and punishments administered by teachers, and the pride and shame experienced by students (Weiner, 1972b).

Weiner asserts that there are basically four causes to which people ascribe success or failure: the difficulty or easiness of a task ("He failed because he had a very hard problem;" "Sure he succeeded. With that job anybody could"); the level of talent or ability of the actor ("She's smart," "He's well-coordinated"); the amount of effort expended ("He really tried hard," "She's lazy,"); and luck ("He failed, not because he wasn't smart, not because he was lazy, and not because the task was so complicated. He just had bad luck"). Ascriptions of cause to talent or effort place the "locus of control" inside the actor, whereas ascriptions to task difficulty or luck place the locus of control outside the actor--an important distinction (Weiner, et.al., 1971).

Programs of research within this approach examine the way in which these perceptions are formed, the factors which influence them, and their consequences for teacher judgments and decisions about pupils, instructional alternatives and themselves.

Program 6.2.1: Examine Teachers' Perceptions of Students

It is well known that teachers do not perceive all their students with equal clarity but we do not know how to reveal these differences in perception, how they come into being, and what their educational consequences are. Such are the problems with which this program would deal.

In many classes there are some students who stand out in the teacher's perception while others are seen dimly, if at all. We know, for example, that some elementary school teachers cannot name all of their students after they have left for the day. When asked to describe their students, teachers give much fuller descriptions of some than of others. Such differences raise the suspicion that there are parallel and causally related differences in the teachers' treatment of students; hence there is a need to understand how the teacher's perceptions of his students come into being. This line of inquiry is clearly related to person perception research in psychology.

The first task is to develop methods that will give us a clearer picture of the teacher's view of his students. It would be helpful to know something about the evolution of those perceptions: how quickly are they formed? how do they change over time? Quasi-experimental procedures, such as tachiotoscopically presented photographs of students, might provide some interesting data.

It is probable, indeed likely, that teachers themselves are only dimly aware of these differences in the clarity of their perceptions. Once we are able to reveal the teacher's perceptual world with some degree of precision and reliability, a wide range of questions can be answered. A few of the more obvious are:

1. What student attributions are correlated with differences in teacher perception? For example, are girls more salient than boys? are high SES students more salient than low SES students?

2. What teacher qualities are associated with these perceptual differences? For example, do experienced teachers see their students more clearly than do novices?

3. What school organizational qualities are related to such differences? For example, how does class size relate to the clarity of the teacher's perceptions?

In addition to these more obvious questions there are many others, such as those concerning the relationships of teachers' perceptions of their students to other streams of educational research, including that on the teacher expectancy phenomenon.

The importance of this line of inquiry depends on demonstrating a linkage between the way teachers see their students and the way they teach them. Thus, we need to search for correlates of teacher perception in classroom action. We need answers to questions such as the following: Are students who are dimly perceived by teachers also the ones with whom the teacher has little interaction? Are students themselves aware of the clarity, or lack of it, of their teacher's perception?

It is important that we not limit our search for educational correlates to what happens during face-to-face classroom interaction. It may well be that teachers' perceptions of their students affect actions and decisions that occur outside class, such as grading and grouping.

Once we understand something about the structure of teachers' perceptions and their correlates, we will be in a position to attempt to alter those perceptions. Such an attempt rests on the assumption that teachers' perceptions can be "improved," i.e., that teachers can be made "more" aware of some of their students and that they can perceive their students with greater accuracy. Training might help to achieve this goal, but so might changes in organizational arrangement (e.g., seating patterns), record keeping, and the like.

Program 6.2.2: Assess the Consequences of Teacher Labeling for Teacher Performance and Student Response.

A substantial body of research literature suggests that school achievement depends not only a child's learning ability but also on the teacher's evaluation of that ability and the subsequent teacher behavior towards that child on the basis of such evaluations. Labeling theorists (e.g., Schur, 1971) report that, in making judgments, persons may employ a wide range of information drawn from a variety of sources. Two major sources of information are available: first-hand information obtained from face-to-face interaction with the person(s), and second-hand information obtained from all sources other than direct interaction. The former source of information comes almost exclusively from classroom interactions; the latter is derived from comments from other teahcers, test scores, prior school records, meeting with parents, or diagnostic information from clinics and agencies.

One special emphasis of labeling theory is found in the stipulation that labels are often derived from the evaluation of behavior. Thus the second-hand information noted above serves as the antecedent condition or background against which behavior is then interpreted. Such a perspective would necessarily change the focus of analysis of why some students do well and others do poorly. The focus would change from the behavior of the student per se to the judgments teachers make about that behavior.

If labeling theory is a theory of interactions, the reaction by those being labeled is critical to the analysis. How a student responds to the attribution of a label by a teacher is linked to both subsequent student behavior and the teacher's evaluation of that student's response. Thus the performance of teachers and students is inextricably linked. The critical task in this regard is to determine how teachers come to hold predispositions toward students and what behaviors of students are most likely to trigger the application of labels.

The judgments teachers make about the behavior of students carry a normative component, i.e., an evaluation of behavior as good, bad, destructive, creative, etc. Labeling theory focuses on ascertaining when the ascription of behavior becomes the ascription of the person. When is the act seen as an indication of the inherent nature of the person? When does a person who commits "bad" acts become a "bad" person? When does a student who performs poorly on one or more tasks become a "poor" student?

The outcome of this labeling of the student as "bright" or "slow" can be assumed to influence both the teacher's treatment of the student and the student's response. A research agenda here would need to examine how teacher behavior is influenced by the labels attached to students and how the students respond, in terms of both self definition and performance.

As has been generally acknowledged in the panel, there are three places where one could intervene to manipulate and so change the teacher-student interactive process: the antecedents, the evaluation, or the behavioral consequences.

1. A concern with antecedents to labeling would focus on images teachers hold of students, how firm such images are, how they may be modified, and what attributes of students seem most salient in the creation of an image.

2. To focus on the evaluation of the teacher is to look at how the act of the student is analyzed and compared to the previous image of the student, to isolate what categories of acts seem to trigger the movement from the analysis of behavior to the imputation of character, to examine how the behavior in question changes the evaluation of the student and moves him, say, from the category of "good" student to "poor" student. Research data suggest that such evaluations affect teacher behavior.

3. A concern with behavioral consequences means investigating the conditions under which the imputation of a label leads to a change in teacher behavior, and causes labels to seem most closely linked to changes in behavior. Thus, are there degrees of salience of labels? Is being "neat" less salient than being "good"?

The focus on consequences of the labeling process necessarily is a focus on interaction. If there is the labeling of a student, one has an image of teacher attitudes. The issue of consequences then relates to whether this image influences subsequent teacher behavior, subsequent student image of self and of teacher, and subsequent student behavior.

What sorts of studies might be introduced to change the process of labeling? This question is one which allows entry points at the stages of teacher images, teacher evaluation processes, teacher behavior, student interpretations, or finally student behavioral response. Each of these stages would necessitate its own set of specific intervention techniques.

Program 6.2.3: Examine Causal Ascriptions and the Educational Process

A rapidly expanding literature in social psychology is documenting the important role of causal ascriptions in human behavior. Causal ascription in educational settings refers to perceptions of the cause of success or failure. A pupil who ascribes his failure to his low ability will behave differently from one who ascribes his failure to teacher bias. The latter ascription might produce anger, while the former might produce shame. Similarly, if a teacher ascribes the student's failure to low ability, his behavior toward that pupil will be different than if he ascribed the failure to lack of effort or the excessive difficulty of the task. Since ascriptions for success and failure pervade the teaching situation, they should be systematically examined.

The large literature in social psychology relevant to this topic includes studies in person perception, comparisons of actor biases with observer biases, self-perception theory, and achievement motivation. The most comprehensive or seminal treatments are Heider's Psychology of interpersonal relations (1958), Jones's and others Attribution: Perceiving the causes of behavior (1971), and Weiner's Achievement motivation and attribution theory (1974).

The objective of this program would be to determine what attributions are made by teachers for the performance of their pupils, to determine the consequences of these attributions for pupil behaviors, and to discover methods for changing attributional decisions.

Many methodologies are appropriate to this general program. They include (1) classroom observations to determine the pervasiveness of attributions, the types made, and student reactions to ascriptions; (2) laboratory studies in which causal ascriptions are manipulated to examine their consequences in controlled situations; and (3) field studies in which cues that might be inappropriately used as bases for inferences, such as family background or even IQ scores, are withheld to examine their influence on ascriptions to ability and effort. Of course, such studies must be carefully planned because of possible ethical issues and any possible interference in the classroom.

Table 6.6 Examining Causal Ascriptions and the Educational Process, as in Program 6.2.3.

What are Information Processing Demands and Activities? What?	Antecedents and Determinants Why?	What are the Consequences? So What?	What are the Possible Changes? How?	What are Feasible Changes? Now What?
Teachers search for the causes or reasons for particular actions, such as poor performance on an examination. Such ascriptions guide a vast array of teacher decisions that influence pupil performance.	A number of possible cues or information sources are or can be used as bases for causal ascriptions; they include sex (females are often seen as having lower ability), race, past performance, IQ score, appearance, time spent at an activity, and pattern of performance (whether increasing or decreasing).	Causal ascriptions might influence (1) liking or attraction to the student, (2) amount of interaction, (3) evaluations, (4) student satisfaction, persistence achievement, and strivings. That is, the ascriptions influence teacher behavior toward the pupils and thus affect the pupils' actions.	If the attributions are nonveridical or dysfunctional, one can (1) alter the cues available or the interpretation of the cues, or (2) influence the reaction to particular ascriptions (for example, the teacher's tendency not to interact with students perceived as low in ability)	Both of these changes are feasible.

Program 6.2.4: Examine Teacher Expectations of Class Performance Level and Their Antecedents and Consequences.

It is known that teachers' differential expectations concerning individual pupils are associated with differential teacher response patterns (Good & Brophy, 1973; Brophy & Good, 1974). Indeed, in some cases it appears that teacher expectations concerning students perceived to have low ability lead to teacher behavior (e.g., giving students reduced response opportunity) that sanctions or perpetuates low achievement. Furthermore, some data suggest that the alteration of teacher expectation and behavior has positive effects upon the achievement and attitudes of students originally perceived as having low ability (Martin, 1973). No comprehensive research has been conducted on how teacher expectations toward the class as a whole influence teacher expectations, behavior, and their resultant effort in relation to individual students. Evidence from one study does, however, suggest that global expectations about the collective ability of students do influence the length of time that teachers spend on particular instructional units.

This program will be devoted to answering a variety of questions related to teacher expectations and class performance. For example, when do teachers form expectations about the ability level of their classes, and how stable are these expectations? Does the global expectation held by elementary school teachers concerning the class predict more specific expectations concerning the class (e.g., expectations concerning achievement in mathematics and science)? What cues do teachers use, and what is the relative weight of such cues? How do differential class expectations influence teacher behavior and student behavior? What strategies can be used to modify teacher expectations of the class, and what are the consequences of such modifications?

The suggested research procedure for this program would be to use interviews and questionnaires to gather data on teacher expectations. Naturalistic observations of classroom processes would provide further information relating global class performance to preactive and interactive aspects of teacher behavior. Ultimately, this information would lead to the development of multiple change strategies and experimental studies under classroom conditions.

Table 6.7 Examining Teacher Expectation of Class Performance Level and Their Antecedents and Consequences, as in Program 6.2.4.

What are Information Processing Demands and/or Activities? What?	Antecedents and Determinants Why?	What are the Consequences? So What?	What are the Possible Changes? How?	What are Feasible Changes? Now What?
What is the nature of inferences that teachers make about the class as a learning unit ... what is a good class, what is an average class, and how well do teacher reports agree with objective records?	1. Past experience. (For example, do marked achievement discrepancies between classes exist and, if so, do they lead to over- or under-reaction on the part of the teacher? 2. Student behavior early in the year, such as general class behavior, or the behavior of a few excellent or difficult cases. 3. Comments from previous years. 4. Morale factors (general to the school, or particular to the teacher or the class). 5. The weight of each cue source.	1. What preactive teacher behaviors (such as selection of books or choice of learning assignments) are influenced by the performance level expectation that the teacher holds for the class as a class? 2. What teacher behaviors (length of lessons, etc.) are associated with the teacher's performance expectations for the class? 3. Do teachers who hold generally low expectations for the class as a class more readily express low expectations for individual students? 4. What is the relationship between teachers' global performance expectations and class achievement?	1. Direct feedback to teachers and teacher trainers about the ways in which class estimates are formed and affect behavior. 2. Attempts to change aspects of student behavior, e.g., during the first week, and their effects upon teachers' expectations and behavior. 3. Direct attempts to change teacher behavior.	

APPROACH 6.3
DEVELOP THE MEANS TO IMPROVE COGNITIVE PROCESSES IN SELECTING AMONG INSTRUCTIONAL AND ORGANIZATIONAL ALTERNATIVES

In addition to making global judgments about pupils, teachers make general assessments about the organization of classrooms and themselves for learning. Teachers have perceptions and make judgments regarding grouping of students, arrangement of physical settings, instructional materials and methods, topics and objectives. These perceptions are of a different order from teachers' perceptions of pupils, but they affect teachers' diagnostic decisions regarding individual pupils and groups of pupils. These perceptions and judgments relate to the teaching of something, somewhere, sometime, or somehow--rather than teaching somebody. Research on the antecedents and consequences of these types of teacher thinking constitute Approach 6.3.

Program 6.3.1: Examine Classroom Grouping Practices as Influenced by Teacher Cognitive Determinants.

A variety of research studies indicate that teachers widely employ grouping practices in their classrooms. Those data also suggest that classroom grouping has an impact on the teacher's approaches to the classroom and students' responses to the classroom experience (Brophy & Good, 1974; Rist, 1973). What is needed is to ascertain teachers' rationale for grouping students, what they hope to accomplish, and what alternatives if any they see to how they currently organize the classroom. The latter point, in particular, relates to examining how central teachers believe grouping to be to the teaching process.

The cognitive antecedents of the grouping of students in classrooms consists of a variety of assumed characteristics of the nature of learning, patterns of classroom management, the ways in which teachers effectively impart material to students, the ways in which students absorb materials, and the testing material.

Grouping within a classroom creates a pattern of classroom organization and a framework for classroom interaction. The critical clinical concerns here would be, How did the teacher come to create

that organization? Under what conditions would that organization change? How firm do the teacher's perceptions of students in various groups become? And how do the groups themselves fit what teachers would want their room to be under ideal conditions?

The antecedent conditions which appear amenable to modification in this program relate to teachers' notions of how to present material, how students absorb material, how classrooms can be managed and organized, and how meaning can be inferred from test material. (These notions would probably be difficult to change.)

The structural changes which can be made relate to patterns of classroom organization. Changing these patterns essentially provides an opportunity to change the patterns of interaction and as a consequence assess the perceptions of the teachers in the changed pattern.

Program 6.3.2: Examine Individualization of Instruction, Especially in Terms of the Conflict Between Diagnosis and Discrimination.

This program was not more fully developed. (See Lightfoot, 1973.)

APPROACH 6.4
EXAMINE THE EFFECTS OF REFLECTION AND FEEDBACK ON TEACHER PERCEPTIONS, ATTRIBUTIONS, AND EXPECTATIONS OF SELF, ROLE, AND TEACHING

Two different topics are the targets of this approach. First, there is the question of teacher characteristics, attributes, and attitudes--how they are formed, maintained, and changed. But there is also the process by which teachers reflect on their own thinking and performance, and the consequences of their actions. The second topic is associated with such terms as self-awareness, self-perception, or sensitivity, when describing teachers' states of mind. The topic involves feedback, or self-confrontation when describing reflexive processes wherein teachers are helped to change their perceptions, policies, judgments, or behaviors by becoming more aware of them.

Let us examine several examples of research on feedback and self-confrontation. Rokeach (1973) has investigated the modification of fundamental beliefs (and associated behaviors) concerning racial minorities through confronting individuals with their own responses to values questionnaires, and the discrepancies between those responses and their general self-perceptions.

Norman Kagan has conducted many studies using videotape feedback to help teachers, counselors and clients confront themselves. Findings suggest that these procedures significantly accelerate the processes of self-awareness, empathy, and personal change (Kagan, et al., 1967).

In studies of teachers' interactions with pupils, various feedback systems have been employed to influence teacher behavior. Good and Brophy (1974) used data from a classroom observation form to increase teachers' awareness of their tendencies to interact with some pupils far less than with others. Behavioral change followed. Morine (1973a) employed both video feedback and review of scores on an interaction analysis instrument to demonstrate modifications in teacher performance. Jackson (personal communication, June 1974) found that merely pointing out to teachers that they typically occupy only certain restricted territories in the classroom geography leads to short-term changes in their locomotion patterns. It is still unclear how long changes due to such short-term interventions last. We suspect, however, that many of these changes are transient and that they must be replaced either with technologies for

continuous feedback, with training programs that lead to internalized self-awareness or self-regulatory practices, or some combination of the two.

In the research literature on judgment and decision making, feedback is also very important. A striking finding reported repeatedly by Hammond and his associates (Hammond & Summers, 1972) is that process feedback--providing feedback on the policies or strategies used to make a decision--is far more effective in modifying a judge's behavior than is outcome feedback--providing the judge with the traditional "knowledge of results." This suggests approaches to research on teaching which combine the findings of studies under Approaches 6.1, 6.2, and 6.3. Those approaches will elucidate the cognitive processes and antecedents underlying teacher decision making and performance. Feeding these characterizations back to the teachers in some form could provide a basis for reflection and modification of behavior. Such methods, which Hammond calls policy or "lens model" feedback, merit consideration by educational researchers.

Thus, although this approach currently contains explicit descriptions of two general programs--teacher self-awareness and teacher motivation--it should be considered a locus for additional important programs of research linking studies of the determinants of teacher performance with projects for systematically modifying that performance.

Program 6.4.1: Develop the Means to Improve the Self-Awareness of Teachers.

The fact that teachers are only partially aware of what goes on around them comes as no surprise, for the same is true for all of us in most situations. Yet it seems reasonable to assume that a heightened awareness is desirable, particularly in those situations where subtle phenomena, such as a puzzled expression, may be of considerable significance. We need to know, therefore, how aware teachers are of themselves, their students, and what goes on between them during the process of teaching.

In order to reveal the "blind spots" of teachers, we need more studies of the sort that have already begun to show how inaccurately most teachers estimate the frequency of their interaction with various students in their classroom. These studies will require classroom observers to tally the flow of events and check those tallies against teacher estimates or predictions.

Once we know more about the phenomena which escape the average teachers "vision," we will be in a position to study the correlates of that blindness. The questions that suggest themselves at this point are abundant. For example, are new teachers less aware of their surroundings than their more experienced colleagues? Is personal anxiety associated with restricted pedagogical vision?

Though we generally assume that it is better to see more than to see less, it is possible that effective performance requires the performer to overlook certain events in order to attend to others. We cannot, in short, see everything at once, nor would we want to. Thus, it is important to ask whether there are limits to the awareness we would like teachers to have. How can we help teachers to be selective in their awareness, attending to some things and ignoring others? Teachers need help, it would seem, not only in looking, but in deciding what to look at.

The fact that observers are expensive and organizationally awkward means that we cannot depend on their presence to provide large masses of teachers with mirrors of classroom action. Though videotape devices may help to provide effective feedback, these too are expensive and tend to be viewed with some suspicion by teachers who feel ill at ease with audio-visual devices. Thus, we must invent new, cheap, and effective ways of providing teachers with the information they require to do a good job. Feedback of evaluation data collected from students may be helpful in this regard, as might a system that legitimates visits from colleagues, but more inventive development of procedures is badly needed.

Program 6.4.2: Examine the Cognitive Determinants of Teacher Motivation.

As in any occupation, the morale and satisfaction of the teacher are important determinants of his or her performance in the classroom. When teachers leave the profession, it is expensive and detrimental to student learning and performance. Hence, we must understand the determinants of teacher motivation and effort. This means examining the particular cognitive processes and structures that influence teacher motivation, such as their level of aspiration, interpretation of their own performance, perception of the classroom and the teaching demands, the difficulty of their task, their goals, and so on.

The effects of various cognitive processes on motivational states are examined in J. W. Atkinson's An introduction to motivation (1964) B. Weiner's Theories of motivation (1972a), and B. Weiner's Cognitive views of human motivation (In press).

A number of research methodologies would be appropriate for this program. One approach might be to interview teachers and use questionnaires in order to identify the correlates of teacher motivation and satisfaction. Additionally, experiments in which motivational determinants would be manipulated to examine their effects in controlled situations could be conducted. Finally, the influence of these factors on actual teaching situations could be scrutinized more closely in field research situations.

Table 6.8 Examining the Cognitive Determinants of Teacher Motivation, as in Program 6.4.2.

What are Information Processing Demands and Activities? What?	Antecedents and Determinants Why?	What are the Consequences? So What?	What are the Possible Changes? How?	What are Feasible Changes? Now What?
A number of cognitive processes and structures can influence teacher motivation. 1. Their perception of their success and failure. 2. Aspirations for the class. 3. Perceived task difficulty. 4. Social comparison processes. (The above are likely to be related to the perceived characteristics of the school, etc.)	More difficult to specify, but include 1. Perceived characteristics of the pupils and school demands. 2. Personal past history. 3. Information from others, particularly teachers and principals.	A variety of effects on teacher performance, including 1. Amount and range of interaction with pupils. 2. Other indices of effort, such as preparation time and innovative projects. These, of course, influence pupil learning and performance.	1. Changes in the perception of the school or pupil. 2. Changes in aspiration and goals. 3. Changes in the feedback given.	All feasible

APPROACH 6.5
EXAMINE ORGANIZATIONAL AND STRUCTURAL DETERMINANTS OF COGNITIVE FUNCTIONING IN TEACHING

The mental life of teachers, whether occupied with thoughts of teaching acts (Approach 6.1), learner characteristics (Approach 6.2), organizing and planning for teaching (Approach 6.3), or reflecting on oneself and one's own functioning (Approach 6.4), does not occur in a vacuum. Indeed, teachers' thinking takes place in a matrix of organizational and structural circumstances. This matrix includes variations (open classroom or traditional settings; individualized teaching system or grouped system; graded or ungraded; self-contained or individualized; 15 pupils or 40 pupils; team teaching or individually managed classrooms; differentiated staffing or traditional staffing; and so on) which affect the cognitive functioning of teachers. The programs of research in Approach 6.5 address the effects of such variables on the mental life of the teacher.

Such organizational or technological changes will not only influence how teachers think and what they think about. These innovations must also be consistent with the realities of how teachers think and feel. That is, the innovations introduced must not ignore the cognitive and attitudinal realities of the prospective users.

Program 6.5.1: Examine the Effects of School and Classroom Organization (e.g., Team Teaching) on the Development and Stability of Teacher Expectations.

We know that teachers form expectations for the performance of individual students during the first few instructional days and that those expectations remain highly stable throughout the year. Limited data are available to describe what precedes the formation of teacher expectations. The process that teachers (working in pairs of groups) use to form collective, shared expectations about individual students has never been subjected to systematic study. Teachers freely provide advice, wishes of good luck, etc., to teachers who "inherit" their students. The same process of information sharing goes on among teachers who are responsible for the same group of learners. The way in

Table 6.9 Examining the Effects of School and Classroom Organization (e.g., Team Teaching) on the Development and Stability of Teacher Expectations, as in Program 6.5.1.

What are Information Processing Demands and/or Activities? What?	Antecedents and Determinants Why?	What are the Consequences? So What?	What are the Possible Changes How?	What are Feasible Changes? Now What?
1. In a complex setting (e.g., 100 students, 3 teachers) what cues do teachers use to form performance expectations for individual students and how comparable are these cues to those used by teachers in self-contained classrooms? 2. What inferences do teachers make about the credibility of judgments that other teachers make about individual students? What are the general inferences that they make about being a team member, and how do these expectations influence the way in which they think about students? 3. In comparison to self-contained classrooms (matched on student SES and aptitude), what is the relative percent of students classified as slow learners (etc.)?	Behavioral cues of students: 1. How much contact do teachers have with individual students in a team setting? 2. What is the frequency and substance of discussion that teacher teams have with regard to evaluation, treatment, etc., for individual students?	1. If teachers have different expectations concerning students, does that fact result in conflicting and self-defeating teacher behavior toward individual students? 2. Does a shared low expectation for individual students lead to inappropriate teacher behavior, and are the effects of consistent low-expectation treatment from several teachers worse than the effects of such treatment from one teacher in a self-contained room?	1. Does the information given to individual teachers or the team about differential expectations and ways to resolve these conflicts have an effect on teacher behavior and student learning? 2. How does interaction given directly to teachers about selected interaction patterns compare with other specific ways of changing such behavior? 3. How effective is training team members in coding and analyzing process measures of classroom behavior? 4. What strategies should be developed to improve the way in which teachers share information and make decisions about students?	

which teachers form collective expectations, the accuracy and stability of such expectations, and their impact upon student expectation and behavior is an important link. Some teachers appear to treat students on the basis of expected achievement, extending differential behavior toward high- and low-achievement students. Finally, it is known that some feedback strategies can be invoked to alter teacher behavior toward low achievement students (Brophy & Good, 1974; Good & Brophy, 1974).

Some of the types of questions to which this research program would be addressed would be, What cues do teachers use (exchange) in the formation of collective expectations, and what is the weight of such cues? Do teacher pairs or teams have more information and awareness of students, or is their common focus on only a few students? How stable are collective expectations, and what is their effect upon student behavior? What strategies can be used to modify collective expectation and what are the consequences of change programs for student behavior?

This program contributes to a collective series of expectation programs as well as to the general approach of the teacher as an information processor. In particular the program of research would help to determine whether shared resources (occurring either naturally or after interventions) are associated with more accurate and broader awareness of classroom phenomena.

The first phase of the research effort would be devoted to using interviews and questionnaires, to collect data, which would be descriptive of the way shared expectations are formed. In the second phase, process observation data would be collected in order to relate levels of the "shared view" to differences in teacher behavior, classroom arrangement, and student learning. Finally, researchers would conduct systematic (multi-project) testing of distinct strategies for changing collective expectations and assessing the impact of these changes through experimental research conducted in a classroom setting.

Program 6.5.2: Examine Pupil Record-Keeping Systems as Determinants of Teachers' Thinking About Pupils, Programs, and Instructional Alternatives.

This program was not more fully developed.

APPROACH 6.6
DEVELOP METHODS FOR RESEARCH ON TEACHING AS CLINICAL INFORMATION PROCESSING

Much of the research described in the above approaches differs in emphasis and theoretical orientation from both the neo-behaviorist experimental tradition and the psychometric tradition that have formed the mainstreams of psychological research on American education. Therefore, neither the experimental design models of Cambell and Stanley (1963) (and their many variants) nor the classical methods of measurement are sufficient in themselves for research in these areas. Approach 6.6 includes a program of research aimed at refining and improving methods of systematic introspection or thinking aloud, decision analysis, anthropological studies of teaching, analysis and coding of complex descriptive protocols, and the like.

Program 6.6.1:- Carry Out General Methodological Studies.

Recent years have witnessed remarkable progress in the development of methods for analyzing, and making explicit, the diagnostic process. Foremost among the analytic techniques are two diverse methods: (a) the lens model, developed by Brunswik (1955, 1956), Hammond (1971), and others, which employs various forms of multiple regression analysis; and (b) process tracing, developed by Newell and Simon (1972), Kleinmuntz (1968), and others, which employs introspective methods to produce a detailed, sequential model in the form of a flow chart or decision tree. These methods can be used successfully (see Slovic & Lichtenstein, 1971; Clarkson, 1962), but certain methodological inadequacies still need attack.

For example, the lens model provides no satisfactory way to disentangle the weights given to cues that correlate highly with one another. In process tracing, the distillation of a model from masses of introspective data remains more an art than a science. The validity of various introspective techniques also needs to be explored. For example, how do the results obtained from having the judge talk aloud while he is processing information and arriving at a diagnosis compare with recall prompted afterwards?

Lens model analysis provides a rough summary of the judge's weighing of cues across a series of judgments. There are, at present, few adequate techniques for quantifying the weighing process for a single judgment.

APPROACH 6.7
DEVELOP THEORY CONCERNING TEACHING AS CLINICAL INFORMATION PROCESSING

Progress in any field of research is likely to be made most easily when clear theoretical formulations are available or can be readily produced. In the absence of theory, constructs refuse to stay put, distinction blur, and discussions repeat themselves endlessly. The problems with which this Panel is concerned will not be solved by more programs of empirical research alone. Serious efforts are needed in theory development in this field, through support of individual theoreticians attempting to formulate parts of the problem area, groups of investigators attempting theoretical rapprochements across formulations, or short-term conferences to bring together representatives of theoretical positions that would otherwise be unlikely to communicate. In some ways, the Panel's discussions represented this third approach. Such an effort is of particular importance in this problem area, since so many types of theory are already brought to bear on cognitive functioning in teachers, yet each is but a partial theory when compared to the full span of cognitive functioning in which teachers engage. The report of Panel 10 on Theory Development contains several suggestions which would be quite fruitfully pursued within the problem area of teaching as clinical information processing.

SUMMARY

This panel was concerned with improving knowledge about the mental life of teachers which is considered to be an "important" determiner of teacher behavior. Innovations in the context, practices, and technology of teaching must be mediated through teachers' minds and motives. Teachers must not only possess relevant instructional skills; they must also be able to diagnose the situations in which a particular set of skills should be used. Similarly, applying behavior analysis appropriately requires accurate perceptions and valid interpretations of student behavior. New roles for teachers and new patterns of staffing must be consistent with the information processing capacities of teachers. In short, the panel was most concerned with improving understanding of the ways in which teachers cope with the demands of classroom life as a basis for the improvement of teaching.

This concern calls for regarding the teacher as a clinician who both diagnoses specific forms of learning dysfunction and prescribes particular remedies for them, and who also aggregates and interprets an enormous variety of information about individual students and the class as a whole. Further, this concern calls for regarding the teacher as one who combines information about students and classes, as well as information from the general and research literature of education, with his own expectations, attitudes, beliefs and purposes. With all of this as a basis, the teacher responds, makes judgments, renders decisions, and begins again.

The first approach deals with the clinical act of teaching--how teachers make diagnostic and prescriptive judgments. The programs here focus on the teacher's decisions about specific acts of instruction. The second approach deals with judgments that result in general characterizations of students, such as decisions that some sutdents succeed because of talent, others because of luck, others because the task is easy, and still others because they try hard. Such judgments contribute to the more targeted clinical decisions considered in the first approach. The third aproach deals with the ways in which teachers make diagnostic judgments about how, what, and when to teach in ways almost independent of particular acts of student-oriented diagnostic teaching. The fourth approach deals with the ways in which the teacher thinks about himself and his teaching as a basis for self-evaluation and, perhaps, revision

of his teaching practices. The fifth approach deals with the ways in which changes in school organization (such as differentiated staffing) or technical support systems (such as those for pupil record keeping) influence the ways in which teachers use information in rendering judgments.

Finally, although two separate panels were expressly concerned with problems of theory and methodology, this panel felt that such concerns were especially germane in an area whose diverse concepts have not been stabilized into a uniform structure, and designated two of its own approaches in recognition of this fact.

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